

What is Claimed:

1. A method for transformer testing, comprising:
 - receiving a failing test result of a transformer, the test result being determined from a test taken during transformer manufacture;
 - determining, via a knowledge-based system, a predicted root cause of the failure based on the test result and a knowledge base of transformer information; and
 - determining, via the knowledge-based system, a suggested course of action for the failure based on the test result and the knowledge base of transformer information.
2. The method as recited in claim 1, wherein:
 - the knowledge base of transformer information comprises a transformer rule;
 - determining the predicted root cause comprises determining the predicted root cause based on the test result, the knowledge base of transformer information, and the transformer rule;
 - and
 - determining the suggested course of action comprises determining the suggested course of action based on the test result, the knowledge base of transformer information, and the transformer rule.
3. The method as recited in claim 1, wherein:
 - the knowledge base of transformer information comprises a transformer rule and transformer fact data;
 - determining the predicted root cause comprises determining the predicted root cause based on the test result, the knowledge base of transformer information, the transformer rule, and the transformer fact data; and
 - determining the suggested course of action comprises determining the suggested course of action based on the test result, the knowledge base of transformer information, the transformer rule, and the transformer fact data.
4. The method as recited in claim 3, wherein:
 - the transformer fact data comprises information representative of a plurality of built transformers, the built transformer information comprising a design specification for each built transformer, and measured test results for each built transformer; and
 - determining the predicted root cause comprises determining the predicted root cause based on the test result, the knowledge base of transformer information, the transformer rule, and

the transformer fact data, the design specification for each built transformer, and the measured test results for each built transformer; and

determining the suggested course of action comprises determining the suggested course of action based on the test result, the knowledge base of transformer information, the transformer rule, and the transformer fact data, the design specification for each built transformer, and the measured test results for each built transformer.

5. The method as recited in claim 4, wherein determining the predicted root cause comprises correlating the test result with the plurality of measured test results for each built transformer.

6. The method as recited in claim 4, wherein determining the suggested course of action comprises correlating the test result with the plurality of measured test results for each built transformer.

7. The method as recited in claim 3, wherein:

the transformer fact data comprises information representative of a plurality of built transformers, the built transformer information comprising as-built information for each built transformer; and

determining the predicted root cause comprises determining the predicted root cause based on the test result, the knowledge base of transformer information, the transformer rule, the transformer fact data, and the as-built information for each built transformer; and

determining the suggested course of action comprises determining the suggested course of action based on the test result, the knowledge base of transformer information, the transformer rule, the transformer fact data, and the as-built information for each built transformer.

8. The method as recited in claim 1, wherein:

the knowledge base of transformer information comprises a transformer rule, the transformer rule comprises a transformer manufacture rule;

determining the predicted root cause comprises determining the predicted root cause based on the test result, the knowledge base of transformer information, the transformer rule, and the transformer manufacture rule; and

determining the suggested course of action comprises determining the suggested course of action based on the test result, the knowledge base of transformer information, the transformer rule, and the transformer manufacture rule.

9. The method as recited in claim 1, wherein:

the knowledge base of transformer information comprises a transformer rule and a transformer fact, the transformer rule comprises a transformer manufacture rule, and the transformer fact comprises transformer manufacture information for a plurality of built transformers;

determining the predicted root cause comprises determining the predicted root cause based on the test result, the knowledge base of transformer information, the transformer rule including the transformer manufacture rule, and the transformer fact including the transformer manufacture information; and

determining the suggested course of action comprises determining the suggested course of action based on the test result, the knowledge base of transformer information, the transformer rule including the transformer manufacture rule, and the transformer fact including the transformer manufacture information.

10. The method as recited in claim 9, wherein the manufacture information for each built transformer comprises at least one of the group of an indication of a manufacturing plant associated with the built transformer, an indication of a piece of manufacturing equipment associated with the built transformer, an indication of a calibration date of manufacturing equipment associated with the built transformer, and an indication of a retooling date of manufacturing equipment associated with the built transformer.

11. The method as recited in claim 1, further comprising:

receiving, from a user interface, additional information associated with the failed transformer;

determining, via the knowledge-based system, a revised predicted root cause of the failure based on the test result, the knowledge base of transformer information, and the additional information; and

determining, via the knowledge-based system, a revised suggested course of action for the failure based on the test result, the knowledge base of transformer information, and the additional information.

12. The method as recited in claim 11, further comprising repeating receiving the additional information and determining revised predictions and suggestions until meeting a predefined certainty.

13. The method as recited in claim 1, wherein the predicted root cause comprises a prediction that a piece of transformer manufacturing equipment is out of calibration.

14. The method as recited in claim 1, wherein the suggested course of action comprises a suggestion to modify a scheduled transformer manufacturing step to compensate for the test failure.

15. The method as recited in claim 1, wherein the suggested course of action comprises a suggestion to redo a previously completed transformer manufacturing step.

16. The method as recited in claim 1, wherein the suggested course of action comprises a suggestion to recalibrate a piece of transformer manufacturing equipment and to redo a previously completed transformer manufacturing step.

17. A system for transformer testing, comprising:
a knowledge base, comprising transformer information; and
an inference engine in communication with the knowledge base, the inference engine being configured to perform:

receiving a failing test result of a transformer, the test result being determined from a test taken during transformer manufacture;

determining a predicted root cause of the failure based on the test result and a knowledge base of transformer information; and

determining a suggested course of action for the failure based on the test result and the knowledge base of transformer information.

18. The system as recited in claim 17, wherein:
the knowledge base of transformer information comprises a transformer rule; and
the inference engine is further configured to perform:

determining the predicted root cause comprises determining the predicted root cause based on the test result, the knowledge base of transformer information, and the transformer rule; and

determining the suggested course of action comprises determining the suggested course of action based on the test result, the knowledge base of transformer information, and the transformer rule.

19. The system as recited in claim 17, wherein:
the knowledge base of transformer information comprises a transformer rule and transformer fact data;
the inference engine is further configured to perform:
determining the predicted root cause comprises determining the predicted root cause based on the test result, the knowledge base of transformer information, the transformer rule, and the transformer fact data; and
determining the suggested course of action comprises determining the suggested course of action based on the test result, the knowledge base of transformer information, the transformer rule, and the transformer fact data.
20. The system as recited in claim 19, wherein:
the transformer fact data comprises information representative of a plurality of built transformers, the built transformer information comprising a design specification for each built transformer, and measured test results for each built transformer; and
the inference engine is further configured to perform:
determining the predicted root cause comprises determining the predicted root cause based on the test result, the knowledge base of transformer information, the transformer rule, and the transformer fact data, the design specification for each built transformer, and the measured test results for each built transformer; and
determining the suggested course of action comprises determining the suggested course of action based on the test result, the knowledge base of transformer information, the transformer rule, and the transformer fact data, the design specification for each built transformer, and the measured test results for each built transformer.
21. The system as recited in claim 20, wherein the inference engine is further configured to perform correlating the test result with the plurality of measured test results for each built transformer to determine the predicted root cause.
22. The system as recited in claim 20, wherein the inference engine is further configured to perform correlating the test result with the plurality of measured test results for each built transformer to determine the suggested course of action.
23. The system as recited in claim 19, wherein:

the transformer fact data comprises information representative of a plurality of built transformers, the built transformer information comprising as-built information for each built transformer; and

the inference engine is further configured to perform:

determining the predicted root cause comprises determining the predicted root cause based on the test result, the knowledge base of transformer information, the transformer rule, the transformer fact data, and the as-built information for each built transformer; and

determining the suggested course of action comprises determining the suggested course of action based on the test result, the knowledge base of transformer information, the transformer rule, the transformer fact data, and the as-built information for each built transformer.

24. The system as recited in claim 17, wherein:

the knowledge base of transformer information comprises a transformer rule, the transformer rule comprises a transformer manufacture rule; and

the inference engine is further configured to perform:

determining the predicted root cause comprises determining the predicted root cause based on the test result, the knowledge base of transformer information, the transformer rule, and the transformer manufacture rule; and

determining the suggested course of action comprises determining the suggested course of action based on the test result, the knowledge base of transformer information, the transformer rule, and the transformer manufacture rule.

25. The system as recited in claim 17, wherein:

the knowledge base of transformer information comprises a transformer rule and a transformer fact, the transformer rule comprises a transformer manufacture rule, and the transformer fact comprises transformer manufacture information for a plurality of built transformers; and

the inference engine is further configured to perform:

determining the predicted root cause comprises determining the predicted root cause based on the test result, the knowledge base of transformer information, the transformer rule including the transformer manufacture rule, and the transformer fact including the transformer manufacture information; and

determining the suggested course of action comprises determining the suggested course of action based on the test result, the knowledge base of transformer information, the

transformer rule including the transformer manufacture rule, and the transformer fact including the transformer manufacture information.

26. The system as recited in claim 17, wherein the manufacture information for each built transformer comprises at least one of the group of an indication of a manufacturing plant associated with the built transformer, an indication of a piece of manufacturing equipment associated with the built transformer, an indication of a calibration date of manufacturing equipment associated with the built transformer, and an indication of a retooling date of manufacturing equipment associated with the built transformer.

27. The system as recited in claim 17, wherein the inference engine is further configured to perform:

receiving, from a user interface, additional information associated with the failed transformer;

determining a revised predicted root cause of the failure based on the test result, the knowledge base of transformer information, and the additional information; and

determining a revised suggested course of action for the failure based on the test result, the knowledge base of transformer information, and the additional information.

28. The system as recited in claim 27, wherein the inference engine is further configured to perform repeating receiving the additional information and determining revised predictions and suggestions until meeting a predefined certainty.

29. The system as recited in claim 17, wherein the predicted root cause comprises a prediction that a piece of transformer manufacturing equipment is out of calibration.

30. The system as recited in claim 17, wherein the suggested course of action comprises a suggestion to modify a scheduled transformer manufacturing step to compensate for the test failure.

31. The system as recited in claim 17, wherein the suggested course of action comprises a suggestion to redo a previously completed transformer manufacturing step.

32. The system as recited in claim 17, wherein the suggested course of action comprises a suggestion to recalibrate a piece of transformer manufacturing equipment and to redo a previously completed transformer manufacturing step.